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What is Infertility?

After trying to have a child for a year without success, couples are said to be infertile. This does not mean they are unable to have children, but that their ability to conceive is being hindered by a medical **disorder**. Couples where the potential mother is over 35 are advised to seek help from their doctor if they are not able to conceive within six months of trying. Couples where the mother repeatedly gets pregnant but is unable to carry a child full term are also considered infertile.

Infertility is commonly seen as a women's problem, but that is not always the case. Men are just as likely to be the cause as their partners. In order to accurately diagnose **fertility** problems and determine the best course of treatment, both partners should be tested. Sometimes the infertile couple both have conditions contributing to their difficulties conceiving, while 10 percent of couples never find out the cause.

Causes of Infertility in Women

- ❶ Failure to ovulate
- ❷ Obstruction of the fallopian tubes
- ❸ Inability for the embryo to implant in the uterus

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Causes of Infertility in Men

- ❖ Decreased number of sperm
- ❖ Complete absence of sperm
- ❖ Decreased mobility of sperm

Types of Infertility

Reasons for infertility vary between men and women, and are linked to a variety of factors. These factors help identify the reason for infertility. Diagnostic testing is used to determine what is causing the infertility.

Factors in Women:

- ❖ **Pelvic Inflammatory Disease (PID)** – A leading cause of infertility in women, PID is usually caused by infection. Typically the infection is from a sexually transmitted disease (STD) – such as chlamydia or gonorrhea. The infection can result in the creation of bands of scar tissue that block the fallopian tubes.
- ❖ **Endometriosis** – This is a condition where patches of the endometrium, the tissue lining the uterus, grows outside the uterus, in or around the fallopian tubes, ovaries or other abdominal locations. This may lead to the blockage of the fallopian tubes by cysts or scar tissue.
- ❖ **Ovulation Disorders** – A number of factors can disrupt the ovaries' normal production and release of eggs. These include hormonal imbalances, stress, smoking, eating disorders, excessive exercise, disorders of the thyroid, pituitary or adrenal glands, and cancer treatments.
- ❖ **Polycystic Ovarian (PCO) Syndrome** – A condition caused by an imbalance of reproductive hormones in a woman's body that interrupts the normal development of the egg-producing follicle and causes the growth of many small ovarian cysts.
- ❖ **Abnormal Cervical Mucus** – Infection or hormonal imbalances may cause women to produce cervical mucus inhospitable to sperm. This mucus may be too thick, too acidic, or contain cells or antibodies that destroy sperm.
- ❖ **Antiphospholipid Syndrome (APS)** – Women with this syndrome may experience repeated pregnancy loss due to the formation of blood clots in the arteries leading to the uterus that cut off blood supply to the embryo. This syndrome is an autoimmune disorder where the body attacks phospholipids.

Factors in Men:

- ❖ **Varicoceles** – Varicose veins in the scrotum can lead to decreased production of sperm and poor sperm circulation. This is a leading cause of infertility in men.
- ❖ **Oligospermia** – Low sperm count caused by an obstruction in the male reproductive tract. These blockages may also result in azoospermia – no sperm count.
- ❖ **Congenital absence of the Vas Deferens** – The absence of the vas deferens, a tube-like organ in the male reproductive system, is a

hereditary condition which may be related to being a carrier of the cystic fibrosis gene.

- ❖ **Other factors** – These include no sperm count caused by a missing piece of the Y chromosome, dysfunctions of the pituitary and adrenal glands, genetic disorders such as Klinefelter's syndrome, Young's syndrome and Kartagener's syndrome, and lifestyle factors. These lifestyle factors include smoking, illegal drug use, or alcohol abuse.

Some reasons for infertility are found both in men and women. They include the following:

- ❖ **Age-related Factors** – With age, the number of chromosomal abnormalities in a woman's eggs increases. This prevents the eggs from going through the normal cell division required to produce a healthy embryo. Age may also affect the performance of the sperm. For women, this drop in fertility usually occurs after age 35.
- ❖ **Sperm Allergy** - Antibodies that react against the sperm may be produced by women or men, causing the sperm to become clumped together and unable to move through the cervical mucus.

Infertility Disorders in Canada

One of every 15 Canadian couples experience fertility problems. Each year, Canadians spend about 30 million dollars on just one technology to treat infertility – in vitro fertilization.

Seven percent of couples in their reproductive years are affected by infertility. Sexually transmitted diseases and delayed childbearing have been identified as two of the most important risk factors of infertility. Twenty percent of infertility among couples can be traced to damage to the women's fallopian tubes resulting from pelvic inflammatory disease.

Genetics of Infertility

The genetics behind infertility differ between the sexes, and the different factors causing infertility.

In Women:

- ❖ **MATER gene** – Researchers are looking into the identification of a gene that may be essential for the development of the fetus past the two-cell stage after fertilization. They began looking for the gene in women with premature ovarian failure after discovering the gene in mice. This is the first report in mammals that a protein in the mother is responsible for the continued development of the fetus.
- ❖ **Abnormal Karyotype** – Karyotype refers to the number of chromosomes an individual has, and any abnormalities in those chromosomes. Deformed chromosomes or abnormal amounts of chromosomes in the cell nucleus are known to be responsible for recurrent pregnancy loss.
- ❖ **Other connections** – Several disorders linked with infertility may have a genetic component, including endometriosis and polycystic ovarian syndrome.

In Men:

- ❶ **Cystic fibrosis (CF) gene** – Men who have no symptoms of cystic fibrosis may find their infertility problems are related to the gene mutation that causes CF. This gene mutation is found in 50 to 83 percent of men with congenital absence of the vas deferens.
- ❷ **Klinefelter's syndrome** – This syndrome affects 7-13 percent of men with a sperm count of zero, making it a common cause of male infertility. Symptoms of Klinefelter's syndrome include small firm testes and excessive development of the male breasts.
- ❸ **Y-Chromosome deletions** – The fact that these deletions are present only in infertile men suggests a cause and effect relationship between deletion and infertility. In 1976, researchers found the deletion of the end of the long arm of the Y-chromosome. This region of the chromosome contains the gene or genes required for the process that creates sperm, although the actual genes responsible for this process have not yet been identified.

Biotechnology and Infertility Disorder Diagnosis

Several different biotechnology tools are used to diagnose infertility disorders, including the following:

Enzyme-Linked Immunosorbent Assay (ELISA)

ELISA-based tests are a common biotechnology technique used to determine causes of infertility in women. Examples include the following:
How do ELISA tests work?

- ❶ **Anti-Phospholipid Antibody (APA) Test** – This test is used to determine the presence and levels of antibodies to phospholipids.
- ❷ **Day 3 Inhibin B** – The level of this hormone in the woman's body determines the ability of the ovary to grow follicles, an essential part of female fertility.
- ❸ **Anti Ovarian Antibody (AOA)** – This test assesses the presence and amount of antibodies which cause reduced ovarian functioning and, in severe cases, premature ovarian failure.
- ❹ **Anti Thyroglobulin (ATA) & Anti-Microsomal Antibodies (AMA)** – These autoantibodies interfere with thyroid functions, and thus with normal metabolism. They may indicate whether a patient is predisposed to autoimmunity which might be related to auto antibodies that interfere with the reproductive process.

Chromosome Analysis

From a blood sample cells are harvested and stained under a microscope. A picture is taken, known as karyotyping, which is used to analyse chromosome number and shape. If an abnormality is detected, further attempts may be made to identify a potential disease.

How does Genetic Testing work?

Biotechnology and Infertility Treatments

Medical techniques used to help infertile couples are called Assisted Reproductive Technologies (ART). They include such techniques as in vitro fertilization and assisted hatching.

[Learn more about Hormone Treatments](#)

Biotechnology is making significant contributions to drug treatments for infertility through the development of hormone-based drugs using recombinant DNA technology. These drugs include the following:

- **Recombinant Follicle Stimulating Hormone (rFSH)** – Highly pure form of female hormone FSH used to stimulate ovaries to release eggs.
- **Human Chorionic Gonadotrophin (hCG)** – Obtained from the urine of pregnant females and standardized by a biological assay procedure.
- **Choriogonadotropin Alfa for injection** – Used to trigger ovulation in women with infertility due to anovulation and to promote final maturation of eggs in the ovaries of women undergoing ART.

The Buzz: Infertility Research and Biotechnology

Biotechnology is moving forward in helping to treat couples who are having difficulty having children.

Ooplasmic transfer is a new and controversial technique that has been used to treat infertile women whose eggs are unable to carry out genetic imprinting – the expression of parent specific genetic material, due to defective enzymes.

The DNA in an egg is usually prepared for fertilization by enzymes produced by the mother so early development can proceed properly. For women who lack proper enzymes, the eggs are fertilized but die before they can be implanted in the uterus.

In ooplasmic transfer cytoplasm, containing healthy enzymes, is taken from a normal human egg and injected into the infertile women's egg(s). The egg is then fertilized with the father's sperm through in vitro fertilization.

Controversy surrounds this procedure because opponents fear the transfer of genetic material from the donor egg's cytoplasm to the fetus through mitochondria contained in the cytoplasm.

Supporters say there is no reason to fear a transfer of important genetic information through the procedure. The genes that may be present in the cytoplasm do not determine a person's personal characteristics, instead they are responsible for coding how food energy is extracted. Also, of the 30 babies conceived through this procedure only two have received genetic data from the donor. It appears there have been no negative impacts on these babies.

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